King (1489)

King Springs, in southwest Christian County [N36°-44′-41″; W87°-36′-52.5″] is a three-spring perennial distributary draining to Little River. These springs, plus an additional overflow spring, are located along a 120 m (400 ft)-long Little River flood channel that is separated from the river by a narrow island. The distributary discharges from the top of the St. Louis Limestone (Klemic, 1966) at about 133 m (435 ft) elevation. A bluehole karst window is located about 90 m (300 ft) S of the main spring, which seasonally maintains a significant flow through a 5 m (15 ft) deep channel. This channel ends at a swallet about 25 m (75 ft) south of the main spring. During low flow the bluehole ceases discharge and becomes stagnant. None of the springs are mapped on the Herndon 7.5-minute Topographic Quadrangle nor the corresponding geologic map. They were inventoried during the early phase of this study.

The combined low-flow discharge of King Springs was 60 L/s (2.1 ft^3/s) on 11-19-97. The main downstream discharge point is a bluehole spring adjacent to a steep bank, which splits into two channels from a 1.5 m-wide (5 ft) rise pool. This main bluehole contributes about 50% of the total volume (Figure 11a). This spring (and an overflow spring) drains from the southwest end of the flood channel while two additional perennial springs, which appear to be free-draining gravity springs, join the river from the north end of the flood channel. The spring furthest upstream contributes about 37% of the total while the third spring adds the remaining 13%. See Figure 11b for a map of the drainage basin.

Figure 11a: King Spring (Major)

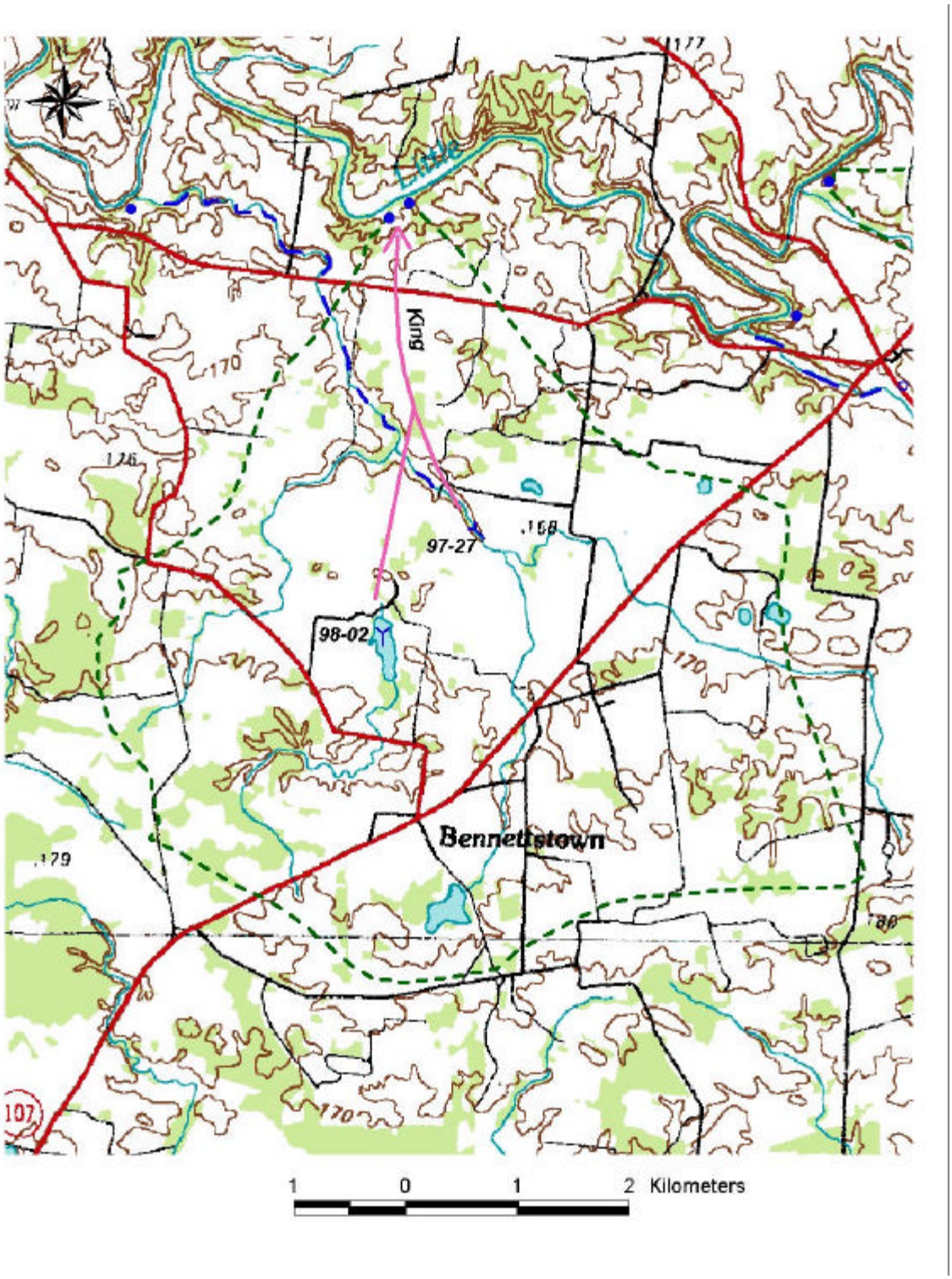

Figure 11b: King Springs Basin:
Low-Flow Discharge 59.5 L/s (2.1 ft^3/s); Basin Area 28.2 km^2 (10.9 mi^2); UBF 2.1 L/s/km^2 (0.19 $ft^3/s/mi^2$); Land use 85.2% Agricultural, 7.4% Forest (4.1% Woody Wetlands)

Dye tests of King Springs:

97-27

December 4, 1997: 250 g (9 oz) of fluorescein was injected into **Thomas Pools**, where a losing stream was infiltrating a gravel channel. Eight days later, three perennial springs within the King Springs distributary, 3 km (2 mi) to the north, were extremely positive (+++) and two overflow springs were positive (+), while nearby McGraw Spring was negative.

98-02

January 13, 1998: 250 g (9 oz) of Direct Yellow 96 was injected at **Smithson Insurgence**. Nine days later, King Spring (downstream), 3.5 km (2.25 mi) to the north, was positive on a cotton dye receptor, while King Spring (upstream) was inconclusive. On *April 9, 1998*, this injection was replicated, with 30 g (1 oz) of fluorescein, in order to confirm the distributary indicated from trace # 97-27. The dye receptor pickup 36 days later indicated that both King Spring, upstream (+) and downstream (+), were positive.

Brelsford (1448)

Brelsford Spring (Figures 12a & 12b) in east-central Trigg County [N36°-49′-19″; W87°-46′-35″] is a free draining gravity spring that flows from the base of a 12 m (40 ft)-high limestone bluff and forms a 120 m (400 ft) spring run to the south side of Little River.

Figure 12a: Brelsford Spring

Figure 12b: Brelsford Spring Basin:
Estimated Low-Flow Discharge 85 L/s (3 ft^3/s); Basin Area 32.9 km^2 (12.7 mi^2); UBF 2.6 $L/s/km^2$ (0.24 $ft^3/s/mi^2$); Land use 65.4% Agricultural, 31.1% Forest

Brelsford Spring discharges from the Upper Member of the St. Louis Limestone (Fox, 1965) at about 114 m (375 ft) elevation. A second discharge point from this system occurs as a boil (Lawrence Boils) along the north bank of Little River about 275 m (900 ft) northeast of the main spring. The trend of the conduit feeding the boil may follow a steep, down-dip path, where the structure dips to the northeast about 15 m (50 ft) over the 275 m (900 ft) distance. A minor cave where the spring flow can be observed is located just northeast of the main spring (Dyas, 1979). Two higher-level short caves, which may have been the original outlets for the basin, are located about 90 m (300 ft) south of the main spring. A possible paleo-spring site may also exist about 180 m (600 ft) southwest of the spring. A 30 m (100 ft)-deep collapse sinkhole containing a 3-6 m wide perennial pool is located about 150 m (500 ft) east of the spring. This collapse sinkhole may be responsible for diverting the conduit flow into two separate discharge points, one of which is confined beneath the Little River.

The spring is named *"Belford Spring"* on the Cadiz 7.5 minute Topographic Quadrangle. However, Charles Morris, who lives nearest the spring, claims that the correct name for the caves

is *"Brelsford"* and produced an old newspaper clipping that referenced the "Brelsford" spelling. According to the undated clipping, stories about the caves include the legends that the outlaw Lonz Pennington used the caves as a hide-out, guerilla bands reportedly hid there during the War between the States, and that a pewter half-dollar counterfeiting operation took place in the caves.

The spring is currently used for a local farm water supply. A submersible pump in the spring run pumps water uphill to the farm. The discharge was gaged at 70 L/s (2.5 ft^3/s) on 9-18-97 (before the related spring boil was discovered on the far side of the Little River). The common source of the two springs was determined in June 1998. The boils, which are located in the edge of the river channel, cannot be easily gaged. However, its discharge was estimated at about 15-20 L/s (0.5-0.75 ft^3/s) during the canoe survey of Little River. Using the more conservative figure, the total discharge of Brelsford Spring basin is about 85 L/s (3.0 ft^3/s). (The main spring was also gaged during the drought of 1999 at 48 L/s (1.7 ft^3/s) (8-24-99). However, this is a less reliable figure because a beaver dam had recently back-ponded the spring run, and a greater portion of the basin's flow may have been diverted to the ungaged boil.)

Dye tests of Brelsford Spring:

98-21

April 8, 1998: 60 g (2 oz) of fluorescein was injected into a losing point through stream gravels on an eastern tributary of Burge Creek, 0.5 km (0.3 mi) north of Pleasant Hill Road, 4.2 km (2.6 mi) southwest of Brelsford Spring. The dye was expected to be recovered in Brelsford Spring but was never detected, probably because an inadequate amount of dye was used (a minimal amount of dye was used in order to avoid discoloring the farm water source).

98-36

June 2, 1998: 1L (0.25 gal) of Rhodamine WT was injected into **Kyler Tile Sink** with 750 L (200 gal) of flush water. This constructed drainage feature consisted of a 0.6 m (2 ft) diameter, 4.6 m (15 ft) deep concrete tile installed into the bottom of a broad sink (even with the drainage tile, the sink holds an intermittent lake for prolonged periods after heavy rains). Fifteen days later Brelsford Spring (+), 3.5 km (2 mi) to the northeast, on the south side of the Little River, was positive. Lawrence Boils (+), located on the north side of the Little River, 900 ft to the NW of Brelsford Spring, was also positive by July 1. This connection indicates that a water-bearing conduit, discharging at a minor bluehole, is confined beneath the bedrock channel of the Little River. With the exception of Little River, all of the streams shown on Figure 12b are dry except after heavy rains.

Mill Stream (0203)

Mill Stream Spring (Figures 13a and 13b), in east-central Trigg County [N36°-50′-38″; W87°-42′-49″], is a rising spring that flows from the base of an 8 m (25 ft)-high limestone bluff, through a 180 m (600 ft)-long pocket valley.

Mill Stream Spring discharges from the base of the Ste. Genevieve Limestone (Ulrich and Klemic, 1966) at about 119 m (390 ft) elevation. Ruins of an old water mill are located about 60 m (200 ft) from the springhead. Mill Stream Spring is one of four named springs on the Caledonia 7.5 minute Topographic Map.

The spring is the resurgence of Sinking Fork, which follows a 7.5 km (4.75 mi) east-west diversion beneath the plateau and rejoins the entrenched channel of Sinking Fork. Two minor sinking streams and numerous sinkholes contribute additional local recharge to the cutoff route, which passes through Pipeline Cave and Boatwright Hole (karst window) en route to Mill Stream Spring (Moore and Mylroie, 1979). The spring was gaged during low flow at 90 L/s (3.2 ft^3/s) and 70 L/s (2.5 ft^3/s) on 9-11-93 and 8-24-99, respectively. Earlier USGS measurements range from 42 L/s (1.5 ft^3/s) (1956) to 5041 L/s (178 ft^3/s) (Van Couvering, 1962).

Figure 13a: Mill Stream Spring

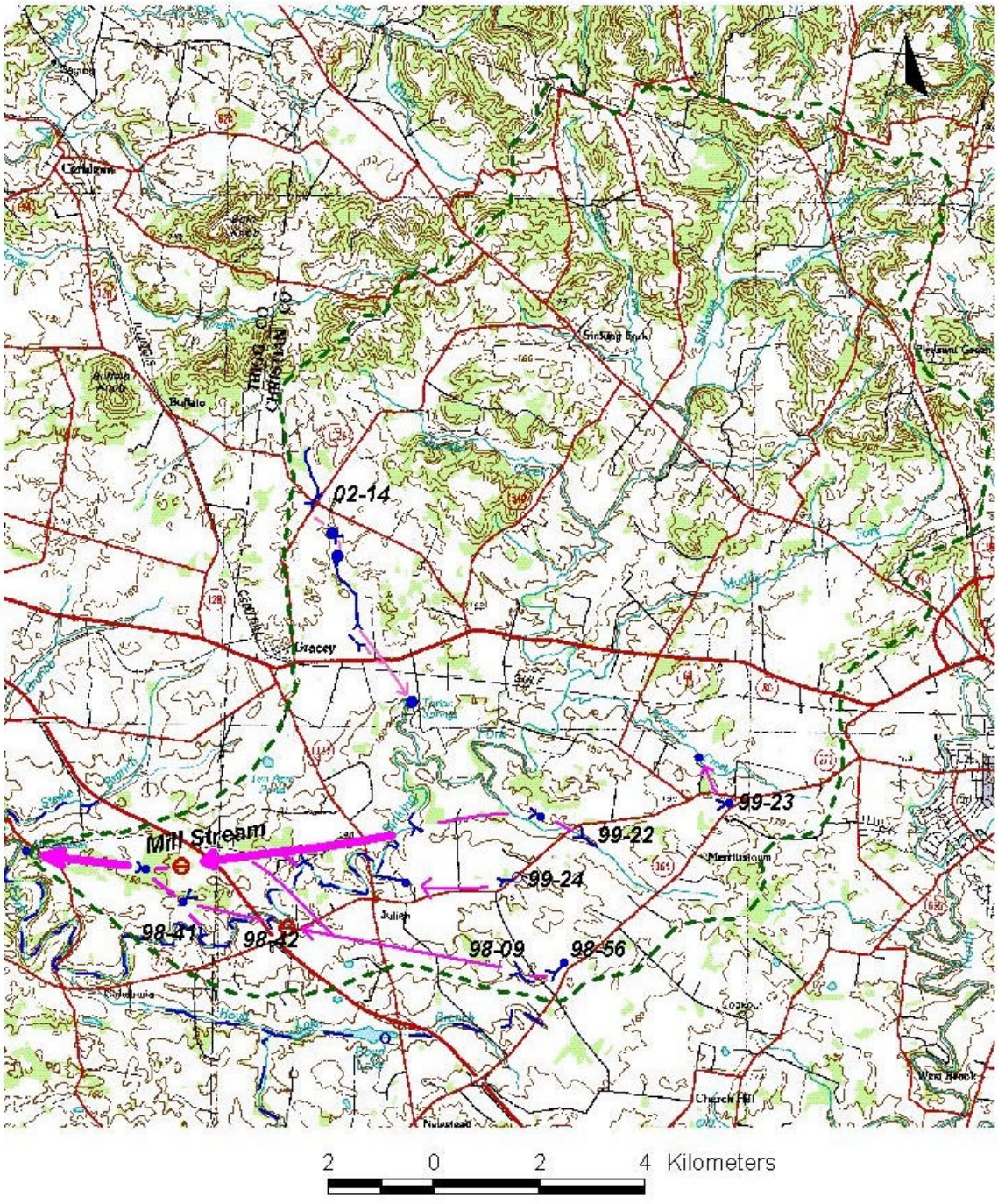

Figure 13b: Mill Stream Spring Basin:

Low-Flow Discharge 82.1 L/s (2.9 ft^3/s); Basin Area 182.1 km^2 (70.3 mi^2);
UBF 0.4 L/s/km^2 (0.04 $ft^3/s/mi^2$); Land use 73.8% Agricultural, 21.9% Forest

(NOTE: Due to access problems, the last two water samples were collected 1.8 km downstream.)

Dye tests of Mill Stream Spring:

98-09

March 17, 1998: 340 g (12 oz) of fluorescein was injected into **Bradey Lane Swallet**. Nine days later Mill Stream Spring (+++), 9.5 km (6 mi) to the west-northwest, was extremely positive while ten other sites were negative. A second site, Cane Spring (+), 5.5 km (3.4 mi) downstream of Mill Stream Spring, was also positive and is interpreted to have received dye from Sinking Fork via a cutoff conduit.

98-41

July 22, 1998: 0.8 L (0.2 gal) of Rhodamine WT was injected into **Old Bridge Swallet** along the channel of Sinking Fork. The Sinking Fork channel was dry except for a minor flow of about 6 L/s (0.2 cfs) runoff from a local small spring, 0.6 km (0.4 mi) upstream. Six days later McReynolds Karst Window (++), Boatwright Hole (+) (karst window), and Mill Stream Spring(++) were positive, while three other sites were negative.

98-42

July 22, 1998: 55 g (2 oz) of eosine was injected at a minor trickle **swallet**, within the dry channel of Sinking Fork, about 90 m (300 ft) downstream of Roaring Crack [Roaring Crack is an unusual feature where a subsurface waterfall can be heard "roaring" beneath the dry channel of Sinking Fork. This location coincides with a mapped fault crossing Sinking Fork. Although the flow could not be directly observed, a dye receptor was tied to the tip of a length of native river cane and pushed down into a bedrock crack. About 3.6 m (12 ft) down, the exposed portion of cane began to quiver when the lower part intercepted the turbulent waterfall. This uniquely placed dye receptor, in addition to an intermittent karst window just up-channel, was positive for dye reinjected at Bradey Lane Swallet, 4.5 km (2.75 mi) to the east-southeast.] Six days later, the same three features were positive as in the **Old Bridge Swallet** dye injection (98-41).

98-09 (Replication)

July, 22, 1998: 280 g (10 oz) of fluorescien was reinjected at **Bradey Lane Swallet** in order to refine the groundwater flow paths beneath the Sinking Fork dry channel, within the Mill Stream Spring basin. Six days later the waterfall beneath Roaring Crack (+++), the karst-window pool just up-channel of Roaring Crack (++), McReynolds Karst Window (+++), Pipeline Cave Stream (++), Boatwright Hole (++) and Mill Stream Spring (+++) were all positive, while Caledonia Bluehole (River Bend basin) was negative. Since Pipeline Cave was positive, this trace indicated a conduit bifurcation upstream of Roaring Crack that diverted a portion of flow north to the main trunk route of Sinking Fork, enroute to Pipeline Cave.

98-56

December 1, 1998: 450 g (16 oz) of fluorescein was injected into the low-flow swallet of **Lilly Spring**. During moderate and higher flow conditions, runoff from this sinking spring continues

down-channel 0.8 km (0.5 mi) to the west to Bradey Lane Swallet. This test was designed to determine if recharge from the low-flow sinkpoint flowed to the same discharge point as Bradey Lane Swallet rather than to the south to River Bend spring. Fourteen days later Pipeline Cave (++) and Mill Stream Spring (+) were positive, showing that this portion of the Mill Stream Spring karst watershed was separate from the River Bend Spring basin.

Minor Sub-Basins within the Mill Stream Spring watershed:

99-22

April 14, 1999: 55 g (2 oz) of SRB was injected at **272 Swallet**, a perennial sinking creek. Seven days later dye was recovered at an intermittent karst window named John Zook Window (++), 1 km (0.6 mi) to the west-northwest, while 11 other sites were negative. This groundwater flow route is interpreted to continue 2.5 km (1.5 mi) to the west to join a trunk flow at the main upstream insurgence of Sinking Fork.

99-23

April 14, 1999: 55 g (2 oz) of eosine was injected at **Anderson Karst Window**, an intermittent bluehole. Six days later Ezell Spring (+++), 1 km (0.6 mi) to the northwest, was extremely positive. [Ezell Spring is a tributary of Riverside Creek and Sinking Fork. The minor amount of eosine used in this trace was slightly detected 13 km (8 mi) west-southwest in Mill Stream Spring (estimated at 25 cfs), whereas the same quantity of SRB, injected 20 percent nearer the spring was not].

99-24

April 20, 1999: 15 g (0.5 oz) of fluorescein was injected at **Price Spring Swallet**, a minor intermittent sinking spring. Nine days later Gee Spring (++), 2 km (1.25 mi) to the west, was very positive, whereas nine other sites were negative.

Walton (1457)

Walton Spring (Figures 14a & 14b), in southeast Trigg County [N36°-44′-32″; W87°-43′-57″], is a free-draining gravity spring that flows from the base of a 4.5 m- (15 ft)-high limestone bluff and develops a 490 m- (1,600 ft)-long spring run to Casey Creek.

Walton Spring discharges from the top of the St. Louis Limestone (Klemic and Ulrich, 1967) at about 134 m (440 ft) elevation. Classic karst windows are located 60 m (200 ft) southeast and 120 m (400 ft) south of the spring. Neither the spring nor the karst windows are mapped on the Roaring Spring 7.5 minute Topographic Quadrangle and were located during hydrogeologic survey for this study. Five low-flow measurements indicate that the spring discharge is about 47 L/s (1.7 ft^3/s) (9-18-97 - 8-23-00) with a drought volume of 25 L/s (0.9 ft^3/s) (12-9-99).